TEST PLAN

Title: Field emission loading accelerated life test - NL12 “Liberty”

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Date Submitted: 1st draft

Revision Number: Rev. 1, (*enter rev. date here*)

Brief Purpose of Test

Perhaps the field emission loading and radiation criteria bounding SRF cavity operation have been set too conservatively.

During commissioning, the criteria were < 1 watt additional heat load attributatable to field emission loading, and < 1 R/hr of FE-induced radiation from operation of each isolated cavity. Two effects could support such criteria: (1) accumulated, irreversible damage to polymeric components or niobium. (2) excessive heat load.

Criterion (2), if not degenerative, is a matter for optimization of capacity and control.

Criterion (1) is unique to Jefferson Lab. No other facility is dependant over such extended timescales on the reliable operation of SRF cavities. It is prudent to demonstrate viability under extended operation prior to relaxing the constraints.

In this test we shall deliberately exceed the commissioning contraints for cavity operation for a period of several months. We intend to operate under conditions which could not be sustained simultaineously for the whole machine, but which would provide an accelerated life test of a cryomodule subject to excessive field emission loading. Should any unexpected and intolerable operational complications be encountered, we would, of course, reduce the operating envelope of the module accordingly.

NL12 is the subject of the test.

Beam Conditions Required

Normal operations

Hardware and/or Software Changes Required

System setup to be complete at the end of the September down.

Baseline TLD measurements during July and August. *Underway, 2nd set placed 7/30.*

Baseline Q measurements during the September down. This data will also allow cross-check of previous calibrations.

Cryogenic heater control for NL12 modified to support up to 200 watts additional rf heating. Claus says no cryo issues. Controls can be tweaked by **Brian Bevins**. RF heater PS may need beefing; presently limited to 165 watts. - *Use existing hardware until demonstrated need to upgrade.*

GSET_max values increased to permit higher gradient operation. *Done*

Initial monitoring to note any increase in incidence of arcing, window heating, or vacuum phenomena.

Periodic change out and reading of **TLD**s from around the module.

Remeasure Qs during January down.

If no degradation noted, continue high load operation through the Spring.

Test and Setup Procedures

Table 1: NL12 - Liberty

	DRVH 7/18	Q (xe9)@field commissioning	old GSET_max	test GSET_max	FE limited
1	7.4	4, 8.2	7.4	**10.5**	x
2	9.4	6, 9.7	9.4	**11.5**	x
3	6.7	1.5, 11.6	6.7	8	
4	9.0	5. 10.2	9.0	**11.5**	x
5	10.4	5, 9.8	10.4	10.5	
6	7.5	5, 11.0	7.5	7.5	
7	7.4	3, 8.5	7.4	**9.7**	x
8	7.2	3, 6.0	7.2	**9.2**	x

Test Results